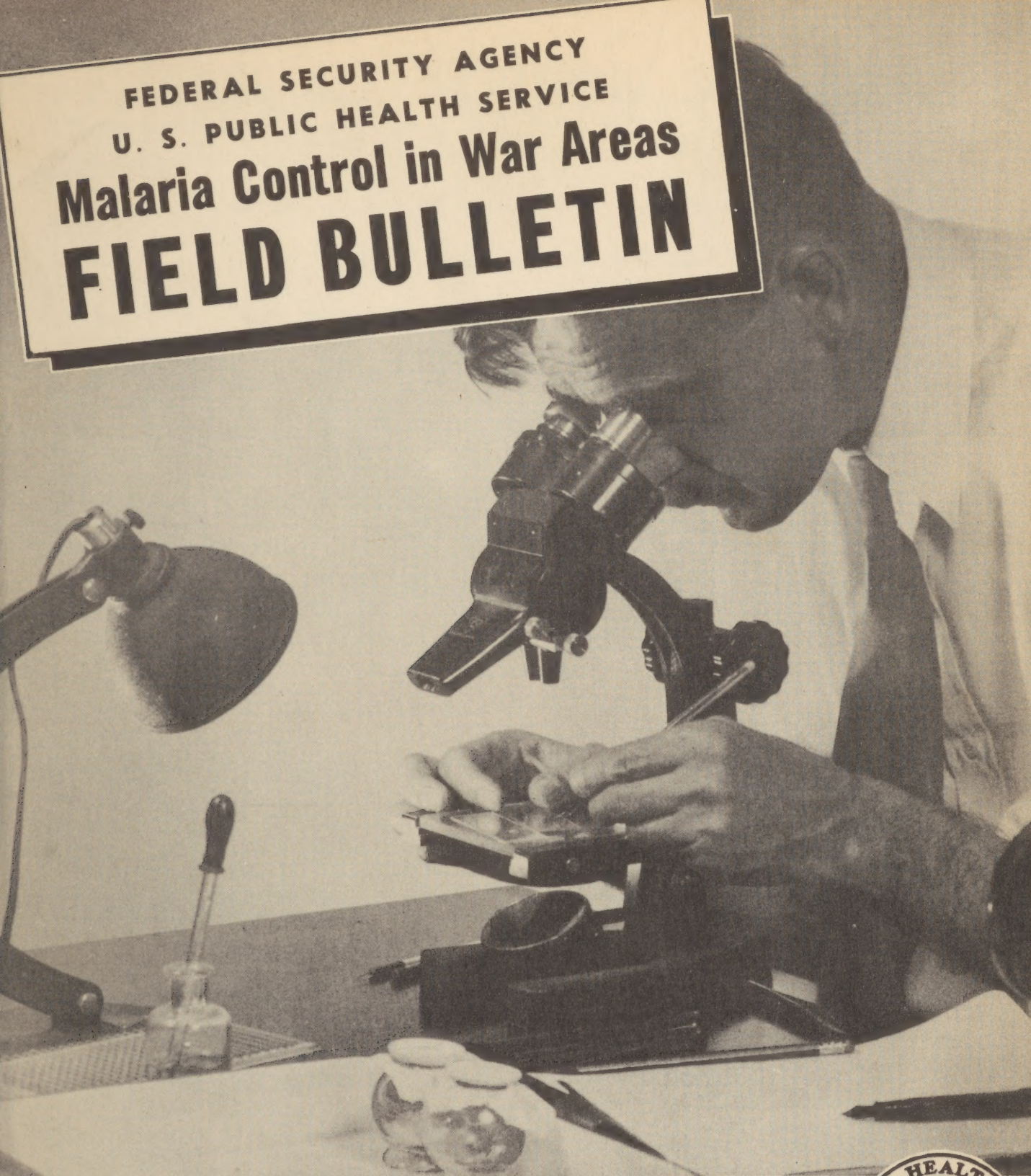


FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
**Malaria Control in War Areas**  
**FIELD BULLETIN**



STUDIES OF FOREIGN MALARIAS

ATLANTA, GEORGIA

AUGUST - SEPTEMBER, 1945

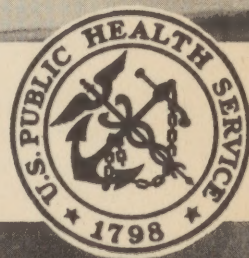




TABLE I  
BCWA Larvicide, Minor & Major Drainage Work  
JULY 1 - 30, 1945

STATE	AREAS IN OPER- ATION	RESIDUAL NUMBER HOUSE SPRAYED	SPRAYING POUNDS DOT USED	LARVICIDAL WORK				DRAINAGE OPERATIONS											TOTAL MAN HOURS
				LARVICIDE USED		SURFACES TREATED ACRES		CLEANING		CLEANING LIN. FT.	NEW DITCHING				DITCH LINING LIN. FT.	UNDERGROUND DRAINAGE LIN.FT.	FILL C.V.	WATER SURF. ELIMINATED ACRES	
				OIL GALS.	PARIS GREEN LBS.	OILED	DUSTED	AQUATIC VEG. ACRES	LAND VEG. ACRES		HAND	LIN. FT. MACH.	DYNAMITE	TOTAL CU. YDS.					
Alabama	7	6,042	2,700	900	108	39	53	3	1	27,879	---	---	---	---	---	---	---	---	16,375
Arkansas	19	27,471	10,350	38,016	847	2,478	392	37	14	11,942	6,393	---	500	285	858	---	---	---	70,488
California	4	---	---	3,204	20	319	6	---	2	112	---	1,800	---	2,000	---	---	---	---	2,962
District I	4	---	---	2,143	5,386	167	2,478	2	1	9,422	14,767	---	---	5,144	---	---	---	---	4,176
Florida	25	4,350	3,257	3,204	809	226	1,023	8	15	396,511	32,150	---	3,805	5,042	2,911	---	---	---	39,171
Georgia	15	6,329	4,892	517	2,332	36	1,930	14	16	46,550	2,336	113	---	555	---	---	435	24	29,047
Illinois	2	---	---	2,315	574	93	462	1	---	2,800	1,700	---	1,330	2,700	---	---	---	7	4,383
Indiana	1	---	---	580	40	55	80	---	---	1,000	---	---	---	---	---	---	---	---	968
Kentucky	10	3,972	1,415	4,840	71	238	34	15	7	4,100	---	---	---	---	---	---	---	---	15,172
Louisiana	8	2,363	1,328	75,811	481	2,896	481	7	30	43,993	1,408	---	---	194	---	---	15	---	51,216
Maryland	2	---	---	---	---	---	---	13	---	1,000	500	---	1,068	900	---	---	200	10	1,954
Michigan	1	---	---	---	---	180	---	79	1	---	---	---	---	---	---	---	---	---	1,406
Mississippi	24	17,572	7,607	17,827	979	742	437	49	66	67,198	---	---	---	---	---	---	---	---	48,737
Missouri	8	7,588	3,996	12,229	4,279	710	2,135	2	46	2,050	1,815	---	1,800	1,803	---	---	4	---	26,118
North Carolina	12	710	305	5,773	64	468	24	64	111	285,106	15,120	---	360	2,037	---	---	4,505	4	25,982
Oklahoma	9	2,000	818	18,947	331	1,133	220	1	12	12,260	2,970	---	---	295	---	---	---	4	18,360
Oregon	1	---	---	468	---	12	---	---	---	---	---	---	---	---	---	---	---	---	88
Puerto Rico	7	---	---	2,482	5,158	192	4,675	3	11	168,688	16,565	---	---	1,570	---	---	---	---	49,067
South Carolina	22	9,629	4,389	11,449	436	696	380	108	96	330,177	9,469	---	---	1,329	---	100	2,293	7	69,468
Tennessee	3	3,616	1,467	10,842	319	477	118	---	4	490	330	---	---	16	380	---	9	---	19,444
Texas	14	11,235	4,649	16,560	315	670	212	128	11	98,312	9,480	26,656	---	9,723	---	---	---	71	62,387
Virginia	4	---	---	15,673	1,182	840	651	28	29	82,853	42,892	---	---	2,453	12	---	311	---	23,182
Mobile Units	---	---	---	1,061	1,185	123	276	1	1	---	925	---	---	73	---	---	---	---	3,649
Total	202	102,467	47,172	244,728	25,094	12,610	16,118	465	472	1,582,343	158,817	28,569	8,863	35,819	4,161	100	11,993	151	383,770
June Total	169	99,970	44,545	216,608	12,653	11,612	10,006	1,161	---	---	166,880	1,610	4,580	21,129	2,063	630	8,228	48	479,231

TABLE II  
BCWA Personnel on Duty and Total Payroll  
JULY 1945

STATE	COMMISSIONED		PROF. & SCI.		SUB-PROF. (1)		C. A. F.		CUSTODIAL AND PER HOUR		TOTAL		PERCENT OF TOTAL	
	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY
Alabama	4	1,249	2	538	21	4,607	2	375	67	8,804	96	14,970	2.14	2.30
Arkansas	13	3,976	4	1,133	38	7,049	8	1,317	414	51,320	477	64,708	10.63	9.94
District of Columbia	1	333	---	---	---	---	1	234	---	---	2	567	0.04	0.09
California	5	1,352	---	---	4	879	2	332	15	1,694	26	4,467	0.59	0.68
Florida	8	2,436	6	1,710	99	17,341	9	1,584	178	22,324	300	45,595	6.69	7.00
Georgia	10	1,116	8	1,260	82	14,763	7	1,162	92	11,744	196	32,047	4.37	4.92
Illinois	3	866	2	469	3	577	1	168	23	3,078	32	5,178	0.71	0.80
Indiana	1	285	---	---	2	391	---	---	10	1,216	13	1,892	0.29	0.29
Kentucky	5	1,474	1	280	31	3,793	4	692	63	7,959	94	14,190	2.10	2.18
Louisiana	8	2,352	2	962	83	10,464	9	1,525	272	35,971	345	51,274	7.69	7.88
Maryland	1	348	---	---	2	401	2	440	10	1,486	15	2,575	0.33	0.40
Mississippi	10	2,892	7	1,892	60	9,804	7	1,312	251	29,829	335	45,689	7.47	7.02
Missouri	2	550	3	649	17	3,488	2	224	183	21,392	207	26,305	4.61	4.04
North Carolina	5	1,427	8	1,570	13	2,542	4	720	161	20,596	188	26,657	4.19	4.13
Oklahoma	4	1,215	3	741	24	3,475	2	308	112	12,426	145	18,167	3.23	2.79
Oregon	---	---	---	---	1	205	---	---	---	---	1	205	0.02	0.03
South Carolina	12	3,562	5	1,704	66	11,182	13	2,027	410	52,988	497	71,473	11.08	10.98
Tennessee	5	1,406	4	1,192	22	3,583	10	1,420	104	11,987	145	19,558	3.23	3.00
Texas	10	2,939	4	1,355	69	13,063	13	2,083	271	34,588	367	54,018	8.18	8.30
Virginia	1	333	2	682	22	3,853	2	457	110	14,676	137	20,001	3.08	3.07
<i>Aedes aegypti</i>														
Alabama	1	285	---	---	8	1,568	1	168	---	---	10	2,021	0.32	0.31
Florida	---	---	---	---	25	4,892	---	---	---	---	25	4,892	0.56	0.75
Georgia	---	---	---	---	5	1,047	---	---	---	---	5	1,047	0.11	0.16
Louisiana	1	285	---	---	7	1,318	1	168	---	---	9	1,751	0.20	0.27
South Carolina	1	285	---	---	6	1,109	1	168	---	---	8	1,562	0.18	0.24
Texas	4	1,140	1	198	27	5,034	2	319	2	326	36	7,017	0.80	1.08
Hq. & Dist. (2)	64	22,223	15	4,055	49	9,599	199	32,196	54	8,443	381	76,816	8.49	11.75
Mobile Units	7	2,203	3	746	16	2,437	3	447	30	4,954	59	10,767	1.33	1.66
Puerto Rico	7	2,122	2	678	8	1,764	6	1,368	280	13,951	303	19,883	6.75	3.05
Honolulu T. H.	3	742	---	---	25	4,325	1	210	3	537	32	5,814	0.72	0.89
Total	196	61,316	78	21,731	785	144,173	312	51,446	3,115	372,375	4,486	651,041	100.00	100.00
Percent of Total	4.37	9.42	1.74	3.34	17.50	22.14	6.95	7.90	69.44	57.20	100.00	100.00		

(1) Includes Entomological Inspectors

(2) Includes Headquarters and District Offices, Malaria Survey, Imported Malaria Control, Special Investigations and employees temporarily attached to Headquarters pending assignment to states.



# STUDIES OF FOREIGN MALARIAS

By Sanitarian (R) Martin D. Young

Officer in Charge of Imported Malaria Studies

U. S. Public Health Service

The program "Imported Malaria Studies" was established in the fall of 1943 by the Public Health Service, in cooperation with the Army and other agencies interested in the public health significance of malarias imported into the United States by returned carriers. The February 1944 Monthly Report of the Office of Malaria Control in War

Areas contained a preliminary presentation of organization and procedures employed. As therein outlined, the objectives of the program were: 1) to determine the ability of imported malarias to infect anophelines which occur in the United States and to be transmitted by them; 2) to gather information on parasitology and other characteristics of these infections, and to distinguish, if possible, between strains; 3) to evaluate the findings and suggest their implications upon control measures. The present report is an account of late developments of the program and of results obtained to date.

## LABORATORIES

Four laboratories served as bases for the experimental projects. Headquarters laboratory is located in the National Institute of Health Research Laboratory, Columbia, South Carolina. Other laboratories were established



Close up of Mosquito Feeding on Patient

at Letterman General Hospital, San Francisco; Harmon General Hospital, Longview, Texas; and Moore General Hospital, Asheville, North Carolina. These laboratories had access to returned servicemen with foreign malaria infection in twelve army and naval hospitals. In addition, cooperation of seven mental hospitals was secured to provide

facilities for transmitting malaria to patients requiring malaria therapy for general paresis.

## METHODS

The procedures used were developed previously at the Columbia laboratory. The routine employed consisted of feeding mosquitoes, preferably in lots of 100 or more, on relapsing cases of malaria, and subsequently dissecting some of them at intervals to determine rates of development and intensity of parasite infections. A mosquito infection was determined by the presence of oocysts, or sporozoites, or both.

Ability of the mosquitoes to transmit malaria to man was determined by allowing mosquitoes from infected lots to feed on neurosyphilitic patients requiring malaria therapy.

An insectary was maintained at each laboratory with *Anopheles quadrimaculatus* Say, or *Anopheles maculipennis*



**TABLE 1**  
*Infectibility of Foreign Malarias to Certain U. S. Mosquitoes*

PROBABLE ORIGIN OF INFECTION	NO. OF PATIENTS	NO. INFECTIVE TO MOSQUITOES	NO. OF LOTS OF MOSQUITOES FED TO PATIENTS	NO. OF LOTS WHICH BECAME INFECTED
Guadalcanal	94	65	97	67
New Guinea	61	32	67	35
Other South Pacific*	24	16	25	16
<b>TOTAL SOUTH PACIFIC</b>	<b>179</b>	<b>113</b>	<b>189</b>	<b>118</b>
Mediterranean	41	30	41	30
Caribbean	6	4	6	4
Burma	1	0	1	0
Liberia	1	1	1	1
<b>TOTAL OTHER AREAS</b>	<b>49</b>	<b>35</b>	<b>49</b>	<b>35</b>
<b>TOTAL OF ALL AREAS</b>	<b>228</b>	<b>148</b>	<b>238</b>	<b>153</b>

\* Includes New Georgia, New Britain, New Hebrides, Tulagi, Munda, Biak, Australia, Bougainville, indefinite.

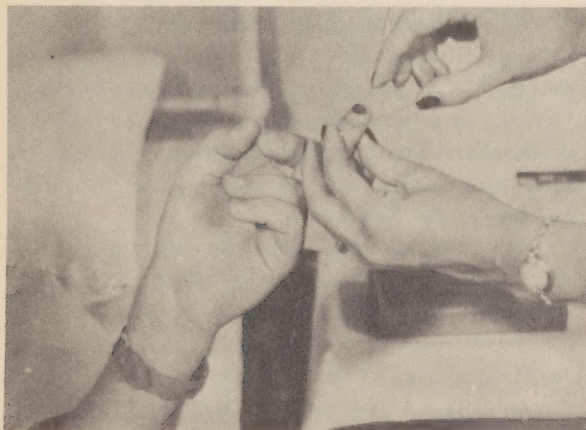
*freeborni* Aitken as the standard testing species. A local strain of *Plasmodium vivax* designated as the St. Elizabeth strain was used for comparison with foreign strains.

### RESULTS

Relapsing malaria infections of foreign origin from 228 servicemen were studied. Three infections were *Plasmodium falciparum* and the rest *Plasmodium vivax*. Of the 238 lots of mosquitoes fed on these patients, 64.3% became infected. Table I shows the

areas in which these infections probably originated, the number of cases which were infective to mosquitoes, and the number of lots of mosquitoes which became infected. Sixty-five per cent of these patients were infective to mosquitoes.

Out of more than one million mosquitoes used in the infectivity experiments, over 40,000 actually fed on malarious patients. The percentage of infected mosquitoes in the samples dissected was 41.4%. Table II shows these results.



Making Blood Smear to Examine for Parasites



Examining Blood Smear for Malaria Parasites



TABLE 11

Total Numbers of Mosquitoes Reared, Fed, Dissected, and Infected

ANOPHELES SPECIES	REARED (pupae)	APPLIED	FED	% FED	DIS- SECTED	IN- FECTED	% IN- FECTED
<i>A. quadrimaculatus</i>	986,613	36,422	30,650	84.2	10,109	4,156	41.1
<i>A.m. freeborni</i>	164,835	16,169	12,787	79.1	4,008	1,884	46.1
<i>A. albimanus</i>	13,014	1,065	645	60.5	425	6	1.4
<i>A. punctipennis</i>	5,294	406	171	42.1	139	70	50.4
<i>A.p. pseudopuncti- pennis</i>	1,075	160	81	50.6	61	15	24.6
<i>A.p. franciscanus</i>	530	88	37	42.0	23	12	52.2
<i>A.m. occidentalis</i>	2,200	285	138	48.4	59	36	61.0
<i>A. walkeri</i>	3,731	120	25	20.8	16	0	0.0
TOTAL	1,173,292	54,715	44,534	81.4	14,920	6,179	41.4

The infectivity of foreign *vivax* malarias to local anophelines, is determined by comparing the rate of infection in lots of mosquitoes fed on carriers with the rate of infection in lots fed on the St. Elizabeth laboratory strain. The same strain of *A. quadrimaculatus* was used for both the laboratory and the foreign malarias. Such a comparison is shown in Table III. This indicates that the percentage of infection among the infected lots of mosquitoes is about the same for both the foreign and the St. Elizabeth strains of *Plasmodium vivax*. The foreign malarias infected *A. freeborni* at a slightly higher rate.

## TRANSMISSION STUDIES

The transmission of malarias to humans was accomplished by allowing infected mosquitoes to feed on neurosyphilitic patients requiring malaria therapy. Arrangements were made with various hospitals to supply the malaria infection used in treating cases of general paresis.

A total of 186 patients were bitten by mosquitoes which were infected from 43 different foreign contracted cases of *Plasmodium vivax*. Positive results were obtained in 154 patients, or 82.8% of the cases. Of the 43 different infections, 34, or 79.1% were infective to patients. White patients

TABLE III

Comparison of Infectibility of St. Elizabeth Strain and Foreign Strains of *P. vivax*

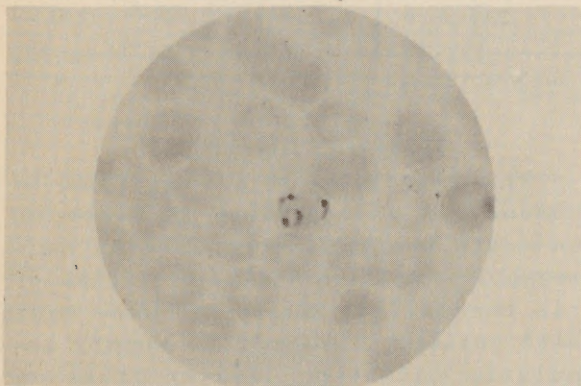
	ST. ELIZABETH STRAIN	FOREIGN STRAINS	
	A. QUAD	A. QUAD.	A. FREEBORNI
Infected Lots	108	105	47
Mosquitoes Dissected	2,277	3,953	2,581
Mosquitoes Infected	1,128	1,926	1,358
Percent Infected	49.5%	48.72%	52.6%



became infected at a higher rate than negroes. However, malarias from each area studied were infective to white neurosyphilitic patients.

### DISCUSSION

Data resulting from the California experiments with *Anopheles maculipennis freeborni* Aitken, indicate that this species is an efficient vector of foreign malarias under controlled laboratory conditions. Furthermore, infections developed in mosquitoes which were kept at temperatures corresponding to those out-of-doors, at Marysville, Cal., during September and October of 1944. Serious situations could conceivably occur in areas



Malaria Parasites in Blood Smear

where relapsing malaria and this species of mosquito are found together under suitable conditions. However, it appears that infections will not develop in *Anopheles maculipennis freeborni* Aitken at ordinary outside temperature in the vicinity of San Francisco. But these mosquitoes can develop infections in warm houses. This indicates that outbreaks of foreign malaria could occur in San Francisco only under unusual conditions, such as exceptionally warm periods lasting at least ten days. If mosquitoes remained in warm houses following an infective blood meal, a malaria infection might develop.

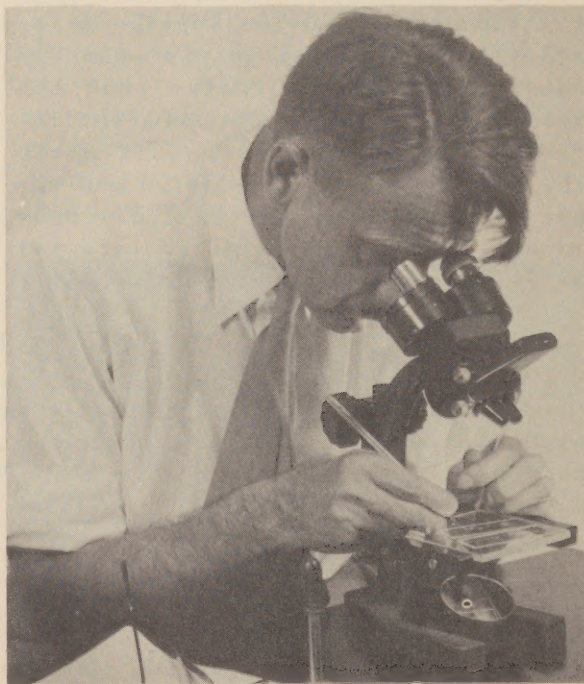
The results from the laboratories in the Southeast indicate that *A. quadrimaculatus* is also an efficient vector under laboratory conditions. This was true for an old established strain

of *A. quadrimaculatus* as well as for a recently established strain. Infections also developed at about the same rate in mosquitoes kept at outdoor temperatures in April and May in Texas. Mosquitoes reared outdoors transmitted malaria infections as readily as those which were raised in the insectary.

Results showed that one foreign strain of *Plasmodium vivax*, designated as the Chesson strain, reacts to drugs differently than our American strains. This strain probably originated in New Guinea. Experiments are in progress to determine the characteristics of the Chesson strain in man and mosquito.

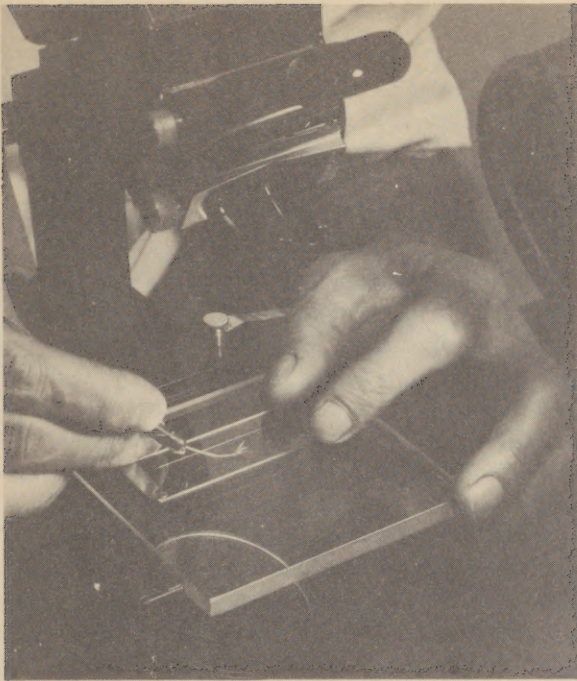
Experiments are being conducted at Moore General Hospital to determine the possibility of infecting mosquitoes with foreign malarias between periods of clinical activity. It is during these periods that patients are most likely to be exposed to mosquitoes, and least likely to be under medical care.

In general, imported malarias originating from widely scattered foreign areas, readily infect the recognized



Dissecting Mosquito for  
Parasitological Examination





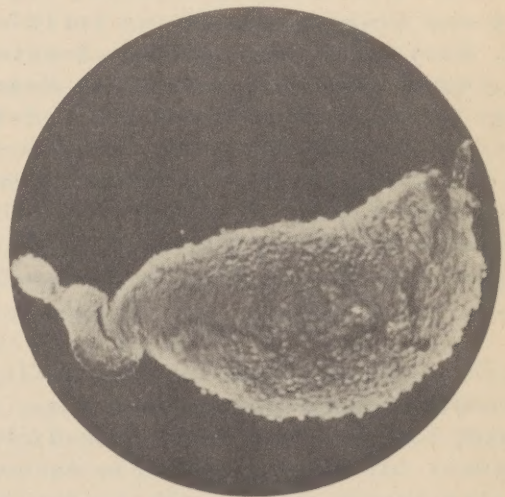
Close Up of Mosquito

domestic malaria vectors, *Anopheles quadrimaculatus* and *Anopheles maculipennis freeborni*, in the United States. *Anopheles punctipennis* also showed a similar rate of susceptibility. These species are different from the vectors in the areas where the malarias originated. The malarias were less infective to other possible vectors including *Anopheles pseudopunctipennis* and *Anopheles albimanus*. The latter, although an efficient vector in some parts of the world, showed a very low susceptibility to the malarias tested.

Other parasitological observations demonstrated that: 1) no decrease in virulence of foreign malarias occurred after successive transfers by United States vectors; 2) the periodicity of the foreign tertian fevers was less than 48 hours; 3) foreign malarias were infective to mosquitoes as long as relapses occurred - it is highly probable that some cases will be sources of infection for several years; 4) some of the foreign infections seem to be strains which are different from native malarias.

## CONCLUSIONS

From the evidence obtained through these investigations, it seems justifiable to conclude that: 1) foreign malarias relapsing in returned carriers can be spread by our native vectors - (this has been demonstrated already by the recent report of two cases which were contracted in Oregon from a returned carrier); 2) the public health hazard of the foreign malarias seems to be as great, if not greater, than a similar number of cases of native malarias; 3) control measures for imported foreign malarias are necessary.



Oocysts on Stomach of Mosquito

## REFERENCES

- Young, M.D., Stubbs, T.H., Moore, J.A., Ehrman, F.C., Hardman, N.F., Ellis, J.M. and Burgess, R.W. Studies on Imported Malarias: 1. Ability of Domestic Mosquitoes to Transmit vivax Malaria of Foreign Origin. Jour. Nat. Mal. Soc. 4(2): 127-131. (June) 1945.
- Moore, J.A., Young, M.D., Hardman, N.F., and Stubbs, T.H. Studies on Imported Malarias: 2. Ability of California Anophelines to Transmit Malarias of Foreign Origin and Other Considerations. Jour. Nat. Mal. Soc. In press.
- Young, M.D., Stubbs, T.H., Ellis, J.M., Burgess, R.W., and Eykes, D.E. Studies on Imported Malarias: 4. The Infectivity of Foreign Malarias to Anophelines of the Southern United States. In manuscript.



# HEADQUARTERS NOTES

## IN-SERVICE TRAINING AND ORIENTATION

The 40th In-Service Training and Orientation course started during August. The regular course was followed with the exception of some of the field observations.

Two DDT spraying projects were completed by the In-Service Trainees. They consisted of intensive spraying operations at the Federal penitentiary at Atlanta, and at the Jonesboro Boy Scout Camp.

Members of the 40th In-Service Training and Orientation Course included: Jr. Asst. San. (R) Lewis R. Joncich; Jr. Asst. Engr. (R) Orville L. Meyer; Eng. Aide Luther Standifer; Jr. Asst. San. (R) Jack Eskridge; Engr. Aide Robert P. Armstrong; Sr. Surgeon Hiram J. Bush; F. C. Tsai, M. D., National Health Administrator, China; and J.R. Herrera, M. D., Director of General Health, Guatamala.

## TRANSFERS:

The following transfers were effective during August: Asst. San. Eng. (R) Vinton W. Bacon from Chief of the Typhus Control Division of the San Antonio Health Department to the In-Service Section of the Training and Education Division, Headquarters; and Asst. Engr. (R) J. Paul Welsh from Gainesville, Fla. to Valdosta, Georgia.

## NEWLY COMMISSIONED OFFICERS

Officers who were newly commissioned in August include: Jr. Asst. Engr. (R) Orville L. Meyer; Jr. Asst. San. (R) L. R. Joncich; and Jr. Asst. San. (R) Jack Eskridge.

## FILM RELEASE

"MOSQUITO PROOFING," a motion picture showing proper methods of mosquito proofing as anti-malaria measures, has been made into a black and white film in quantity. This film is available for unrestricted distribution. Its production number is MCWA-TE-4-022.

## SPECIAL CONSULTANT'S COURSE

A special Medical Malaria Control Consultant's Course was given during August by the In-Service Training Section of the Training and Education Division. It was attended by physicians from local and state health departments in marginal malaria states.

The purpose of this refresher course was to review the principles and procedures employed in laboratory diagnosis of malaria, and to stress the necessity of accurate case reporting. In this way, local health officers are informed of basic considerations in malaria epidemiology and are prepared to evaluate accurately, reported or suspected outbreaks of malaria. Entomological surveys and plans for control operations can be made by State Health Departments or by District U. S. Public Health Service offices.

The course included a general introduction, and an account of medical, entomological, and engineering aspects of malaria. Special emphasis was given to the medical problems. Field demonstrations, including entomological surveys and control measures were part of the program. Lectures on parasitic diseases and murine typhus fever were included also. Courses similar to the one given in August are planned for the future.

Those attending the course in August were: J.T. Herron, M.D., Acting Director of the Bureau of Local Health Service, Arkansas State Board of Health; C.R. Gregg, District Health Officer at Hugo, Oklahoma; and W.M. Wood, M.D., Director of the Cooperative Health Unit, District No. 1, Tahlequah, Oklahoma.

## MEDICAL ENTOMOLOGY COURSE

A two-day course in Medical Entomology will be included in each Tropical Disease Laboratory Course. The suggestion that this be included was made by Surgeon Seward E. Miller and S. A. San. (R) Marion S. Brooke. Lectures are to be given by S. A. San. (R) Herbert Knutson of the In-Service Section of the Training and Education Division, Headquarters. The first of these special courses is scheduled for Oct. 18-19.



## ATLANTA DDT DUSTING PROGRAM

A DDT dusting project, just begun by the Typhus Control Program of the Atlanta City Health Department co-operating with the PHS Training and Education Division, is under the direction of Asst. San. Engr. (R) Vinton Bacon. Personnel will be trained on the project, and will then be sent out in crews of twelve men each. They will dust rat runs and burrows in the business sections of the city on a premise-to-premise and a block-to-block basis.

### VISITORS TO TYPHUS COURSE

A number of prominent scientists from the United States and foreign countries visited the Typhus Control Course during September. They include F.C. Tsai, M.D., M.P.H. of the Chinese National Health Administration; J.R. Herrera, M.D., Director General of Public Health in Guatemala; Geo. C. Payne, M.D., of Mexico City; John T. Emler, Jr., Sc.D., of the Johns Hopkins School of Hygiene; J.H. Brown, of the Entomology Division, Department of Public Health, Alberta, Canada; Lt. Col. Keller, Army School of Malariology in the Canal Zone; and Capt. Chick of Lawson General Hospital, Atlanta.

The visitors attended sessions of the course, viewed typhus films, and were issued typhus literature.

### LINDSEY GIVEN N.I.H. ASSIGNMENT

Asst. San. (R) Dale R. Lindsey has been transferred from Kansas to Pharr, Texas, to assist in studies to determine the effect of fly control on the incidence of dysentery and diarrhea. This is a cooperative investigation with the National Institute of Health.

### IN-SERVICE TRAINING EXPANDS

Considerable expansion in the scope and duties of the In-Service Training Section was announced in the Section's monthly report to the chief of the Training and Education Division.

Activities of the section now include the regular three-week In-Service Training and Orientation Course; a special one-week course for Medical Malaria Control Consultants; a two-week Typhus Control Course dealing with DDT dusting; a six-week intensive Typhus Control Course; and a two-day course in Medical Entomology, as part of the Tropical Disease Laboratory Course.

### DR. COATNEY ADDRESSES SEMINAR

San. (R) G. Robert Coatney addressed those attending the seventh Monthly Seminar, September 19, on the subject "Studies on Chemotherapy of induced Malaria."

### THIRTEEN COMPLETE TYPHUS COURSES

Thirteen trainees completed the first two-week Typhus Control (DDT Dusting) Course, which was held Sept. 17-28. The course included lectures, discussions, and field instruction. Small groups of trainees were assigned to dusting crews for the field work.

Those completing the course included: S.A. San. (R) Robert E. Smith; Asst. Engr. (R) Clifton A. Wilson; Asst. Engr. (R) Ross W. Buck; Jr. Asst. Engr. (R) O.L. Meyer; Jr. Asst. Engr. (R) Lewis R. Joncich; Engr. Aide William H. Slaughter; Engr. Aide Jose E. Balado; Draftsmen Walter O. Costello; Engr. Aide R.P. Armstrong; Engr. Aide William E. LaGrone; Engr. Aide McLeod Hutson; Engr. Aid Thomas B. Gaines; and E.A. Wofford, Assistant Project Superintendent of Capital Homes, City of Atlanta.

### MEDICAL MALARIA CONTROL COURSE

The second of the series of special courses for Medical Malaria Control Consultants was held Sept. 17-21. Those who attended include: Dr. Carl F. Jordan, Iowa State Department of Health; Dr. Harry H. Henderson, Virginia State Health Department; Dr. C. P. Stivik, North Carolina State Board of Health; Prof. Donald A. Wilbur of the Entomology Department, Kansas State College; and Mr. York of the Sanitation Office at the U.S. Penitentiary in Atlanta.



# DIVISION NOTES

## SCROLL OF MERIT TO MOBILE ALABAMA AEGYPTI UNIT

Each Friday a letter written by the columnist M. O. Beale of the Mobile Press Register discusses, criticizes, or otherwise calls attention to local conditions or problems of special interest to the people of Mobile, Alabama. The following is written in recognition of an achievement which the columnist feels merits the public mention and the week's "Scroll of Merit." This letter appeared in the August 31 edition of the Mobile Press Register.

"Dr. O. L. Chason, Health Officer, Dear Sir: My own observations and various accounts which have come to my attention convince me that the mosquito control unit of the health department has done a creditable work in Mobile.

It appears quite conclusive that the staff assigned to this service has been efficient in two particular respects. First, the inspectors have found and caused to be eliminated many mosquito 'nests', such as discarded cans, pans, and buckets in which rain water has accumulated. In addition, the public has been brought to a greater realization of the dangers of these conditions with a result that householders as a rule may be expected to strive harder in the future to keep their premises free of them.

Of course, the problem demands continuing diligence. I do believe, however, that the control unit has made substantial progress toward minimizing it. This week's M. O. Beale Scroll of Merit is awarded to your department in recognition of the work done by the mosquito control staff.

Civically yours, M. O. Beale"

## LAKE TEXOMA SURVEY ORGANIZED

During August a malaria survey was initiated at Lake Texoma, in Texas and Oklahoma, among the residents of the area adjacent to the recently constructed Dennison Dam. The survey was organ-

ized by Surgeon (R) Reuben F. Reider of Santee-Cooper. Arrangements were made with the Oklahoma and Texas state and county health officers for making thick blood films of all people living within one mile of the reservoir. The films will be examined at the Memphis laboratory.

## INTERNSHIP FOR PUBLIC HEALTH WORKERS

An Internship in Public Health Vocational School is being developed for people who are entering the various fields of public health. Individuals may receive training in line with their particular interests. Internship will be provided for trainees from local and state health departments, and for those training for Federal government service. The course is open to administrators, nurses, sanitarians, health educators, and other public health workers. Provisions are made for the interneers to receive public health experience under a well qualified teaching staff. The program is under the supervision of Sr. San. Engr. Ellis S. Tisdale and S. A. Surgeon Robert H. English.

The Savannah-Chatham County Health Department has been selected for the first training course. Here the interneers receive training in a large, representative city-county health department.

Each course lasts approximately three months. The first week is devoted to orientation and to study of the interrelations between federal, state, and local health departments. This is followed by three weeks of basic training in public health. After this, the interneer is given an opportunity to perform work in specialized fields under competent supervision. Basic principles of public health practices are brought to his attention through the use of selected work projects, lectures, demonstrations, visual aids, round table discussions, and actual field experiences. When the newcomer to the field of public health has completed the three months training course, he will have gained a broad concept of the public health program in America.



## FIELD BULLETIN CHANGED TO QUARTERLY

In the future, the MCWA Field Bulletin will be issued as a quarterly. The August and September numbers are combined in this issue; the October, November, and December number will appear as the first quarterly edition.

### EYE-GNAT OUTBREAK IN GEORGIA

Sr. San. (R) G. H. Bradley made a brief survey of an outbreak of eye-gnats in Burke County, Georgia, on September 19 and 20, at the request of local and state health departments.

*Hippelates pusio* Loew, the insect causing the trouble, does not bite, but irritates the eye membranes with its spined labellum as it laps the pus and lachrimal secretions. Infections are most common among children. Dr. Lundquist, Burke County Health Officer stated that probably 75 percent of the younger children may be afflicted with sore eyes due to a *Micrococcus* infection from gnat attacks during the season from July to October.

These insects are very persistent and children are not as careful as adults in brushing the gnats from the eyes.

A number of repellents on the market give excellent protection. These are harmless to humans, and a small amount may be applied about the ears, or sprayed lightly on the hair.

Eye-gnats breed most abundantly in freshly plowed soil and in decaying organic matter. Control of *Hippelates* gnats is difficult and involves a combination of measures. Control of immature stages requires cultural methods, such as light disking of the soil; and clean-up measures, such as removal of garbage, piles of manure, and other decaying matter in which larvae may breed.

Adults may be controlled with specially constructed traps baited with liver. These traps are described by R. W. Burgess in Circular E 335, published by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

## MURINE TYPHUS INVESTIGATION PROGRAM INAUGURATED IN SOUTH GEORGIA

In cooperation with the Georgia Department of Health and the U. S. Public Health Service, health departments of several counties in southern Georgia are conducting studies to evaluate the efficiency of murine typhus control in human and rodent populations.

P.A. Surgeon Elmer L. Hill, of the Medical Division of M.C.W.A., has planned for the testing of several methods of control. These include: 1. DDT dusting of rat runs and harborages; 2. Rat eradication combined with rat proofing of business establishments in a continuing program; 3. A single rat-poisoning campaign. Each type of control will be studied in a county-wide project. Other typhus technics may be studied as the program progresses.

Quantitative evaluations will be made to determine the degree of typhus infection among rodents and the distribution of rodent ectoparasites, incidence and prevalence of typhus in rats and in humans, and seasonal fluctuations of ectoparasite populations. After investigations have been made to provide a base line for future comparisons, control operations will be carried out, beginning in 1946.

In September, Sanitarian (R) J. J. Essex, Executive Officer in Charge of Field Operations, established an Area Headquarters office, at Thomasville. Dr. Essex, a veterinarian by profession, is an expert in rat control. He comes to this assignment after four years in the Public Health Service - Typhus Control Unit - and a total of twenty-five years in rodent control work for the Service.

Associated with the project are: P.A. San. (R) Harvey B. Morlan and Asst. San. (R) Charles E. Kohler, Entomologists; San. (R) M. N. Bader, a veterinarian experienced in rickettsiology; Asst. San. (R) Jack B. Rice, Jr. Asst. San. (R) Jack Eskridge; and Public Health Nurse Lavern Johnson. Technicians, rat trappers, and other workers are being trained on the project.



# CARTER MEMORIAL LABORATORY NOTES

## CONTROL OF FLIES IN RESTAURANTS

The greatest limiting factor in restaurant fly control is the difficulty of treating surfaces which will be available to flies during the day. At night they seek the walls and ceilings, and in this way contact enough DDT to free the buildings of flies by the beginning of each day. But during the day, flies enter restaurants and build up the population. They contact untreated furniture and equipment without coming into appreciable contact with a treated surface until evening. This seems to be especially true in rooms with high ceilings and highly finished wainscoting, and in rooms such as kitchens which have much equipment with numerous areas and surfaces that cannot be treated easily.

## CONTROL OF FLIES IN DAIRIES

Laboratory panel tests are underway to determine whether certain types of white wash act as favorable sizing agents for effective application of DDT. These tests were prompted by the excellent fly control experienced in one whitewashed dairy, even ten months following DDT spraying. The first five months after it was sprayed, very few flies were seen about the dairy. Grill counts for the eighth and ninth months averaged only 14 flies per inspection. This level of control has been maintained in spite of poor sanitation of the premises.

## LABORATORY STUDIES ON THE LOSS OF DDT FROM WATER

Results indicate that some DDT is inactivated by mud at the bottom of swamps and ponds. Samples of mud were tested from 26 anopheline-producing areas. These were placed in separate containers of water, and 0.25 mgs. of DDT dissolved in alcohol stirred into each. Results of 22 samples showed that 17 lost their toxicity within

two weeks. Results of other tests showed that samples which were stirred several times a day lost their toxicity slightly more rapidly than those which were not stirred at all.

## EFFECTS OF DDT ISOMER LARVICIDE TESTS ON FISH AND ASSOCIATED ORGANISMS

Pond organisms including mosquito larvae were not appreciably affected by a DDT byproduct oil used as a larvicide at the rate of 0.1 lb. per acre. Applications at the rate of 0.4 lbs. per acre controlled mosquito larvae and killed some of the larger surface organisms. Microscopic studies indicated a significant kill of some important organisms used by fish for food. Treatment at the rate of 1.0 lb. per acre killed crayfish, fish, tadpoles and micro-crustaceans. At 2 lbs. per acre even fish in the deeper waters were destroyed.

Comparisons were made of samples of plankton taken from ponds just before, and again 48 hours after they were sprayed with DDT. The dosage used was 0.1 lb. of DDT per acre in pyrophyllite dust. Results indicated a significant increase in numbers of green algae and flagellates, but a decrease in numbers of *Sarcodina* and *Ciliata*. Other organisms showed slight quantitative changes.

## ANOPHELINE DDT RESIDUAL SPRAYS

A series of panels was sprayed a year ago to check the relationship between adult mosquito mortality and the length of time the adults contact known concentrations of DDT deposits. Results indicate that the mortality rate is greatly affected by the length of the exposure period. If a given exposure will kill 80 percent of the adults present, an average of twice this exposure period is necessary to kill the remaining 20 percent. Residual deposits of 100 mgs. per sq. ft. were found to be superior to those of 50 mgs. No marked increase in efficiency was evident in deposits exceeding 200 mgs.



TABLE I  
MCA Larvicide, Minor & Major Drainage Work  
JULY 29, - AUGUST 25, 1943

STATE	AREAS IN OPERA- TION	RESIDUAL NUMBER HOUSES SPRAYED	SPRAYING POUNDS DOT USED	LARVICIDAL WORK				DRAINAGE OPERATIONS											TOTAL MAN HOURS
				LARVICIDE USED		SURFACES TREATED ACRES		CLEARING		CLEARING LIN. FT.	NEW DITCHING			DITCH LINING LIN. FT.	UNDERGROUND DRAINAGE LIN. FT.	FILL C.Y.	WATER SURF. ELIMINATED ACRES		
				OIL GALS.	PARIS GREEN LBS.	OILED	DUSTED	AQUATIC VEG. ACRES	LAND VEG. ACRES		HAND	LIN. FT. MACH.	DYNAMITE					TOTAL CU. YDS.	
Alabama	5	5,482	2,616	2,050	186	75	145	17	3	13,480	---	---	---	---	---	---	---	---	15,948
Arkansas	19	26,749	11,434	36,305	548	2,067	222	37	25	24,096	4,410	---	---	401	554	---	---	---	70,038
California	4	102	23	2,343	15	185	5	---	1	7,650	---	---	---	---	---	---	---	2	2,992
District 1	3	---	---	4,768	3,372	376	1,599	2	2	98,500	13,495	---	---	3,957	---	---	---	---	3,646
Florida	26	6,050	4,353	4,660	2,692	208	806	21	9	198,843	14,131	---	---	519	1,834	1,951	58	9,179	37,662
Georgia	18	7,692	5,910	543	2,424	118	1,978	9	12	32,175	785	---	---	51	---	---	758	---	27,086
Illinois	2	---	---	2,048	989	63	825	---	1	13,600	125	---	---	3,760	1,243	---	---	---	3,702
Indiana	1	---	---	1,810	12	120	15	---	---	1,000	---	---	---	---	---	---	---	---	1,806
Kentucky	10	4,726	2,024	4,732	38	245	33	7	---	1,283	---	---	---	---	---	---	---	---	15,390
Louisiana	8	2,439	1,432	83,884	488	3,586	494	10	15	41,689	2,005	---	---	143	---	---	---	---	50,578
Maryland	1	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	182	---	1,166
Michigan	1	---	---	---	445	---	142	3	---	---	---	---	---	---	---	---	---	---	800
Mississippi	24	19,281	8,958	18,793	1,617	684	818	51	48	49,805	---	---	---	---	---	---	---	---	49,415
Missouri	8	5,329	2,025	12,148	5,526	735	2,525	1	7	1,400	150	---	---	3,600	2,952	---	---	---	27,102
North Carolina	13	757	217	9,190	135	438	21	20	70	166,080	12,501	---	---	350	1,597	---	161	1,734	24,930
Oklahoma	9	2,682	980	24,656	550	1,383	346	2	3	---	1,488	---	---	242	---	---	---	2	20,942
Oregon	1	---	---	695	---	14	---	---	---	---	---	---	---	---	---	---	---	---	176
Puerto Rico	7	221	635	3,321	6,757	207	5,000	5	6	169,700	7,990	---	---	732	---	---	---	1	46,820
South Carolina	22	9,116	4,211	12,191	388	637	301	140	90	444,765	12,961	---	---	1,321	---	100	633	26	66,163
Tennessee	3	3,971	1,638	10,232	188	406	37	2	2	---	200	---	---	19	385	---	97	---	17,367
Texas	14	9,299	4,164	16,597	536	746	453	66	17	94,897	3,639	---	---	192	---	---	7	8	60,086
Virginia	4	---	---	16,174	416	335	261	8	22	91,444	41,507	---	---	2,321	---	---	244	---	17,617
Mobile Units	---	---	---	1,354	237	167	394	---	---	---	---	1,000	---	5,398	---	---	700	---	3,310
Total	203	105,896	51,820	268,536	27,557	12,783	16,440	411	333	1,450,407	118,386	1,000	8,229	22,303	2,690	319	13,514	90	566,724
July Total	202	120,035	60,361	244,728	25,094	12,610	16,118	485	472	1,582,343	158,817	28,569	8,863	35,819	4,161	100	11,993	151	583,770

TABLE II  
MCA Personnel on Duty and Total Payroll  
AUGUST 1943

STATE	COMMISSIONED		PROF. & SCI.		SUB-PROF. (1)		C. A. F.		CUSTODIAL AND PER HOUR		TOTAL		PERCENT OF TOTAL	
	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY
Alabama	4	1,349	2	535	19	3,549	3	531	60	8,385	88	14,149	1.93	2.11
Arkansas	15	4,289	5	1,447	39	7,240	9	1,600	433	55,501	501	70,077	11.00	10.44
California	6	1,696	---	---	4	879	2	356	17	2,261	29	5,172	0.64	0.77
District of Columbia	1	333	---	---	1	84	1	254	3	485	6	1,126	0.13	0.17
Florida	2	2,436	6	1,710	108	19,501	11	1,762	184	23,857	317	49,266	6.96	7.34
Georgia	11	3,163	5	1,142	80	14,815	7	1,147	95	12,516	108	32,785	4.35	4.88
Illinois	3	952	2	469	3	571	1	108	16	2,119	25	4,279	0.55	0.64
Indiana	1	285	---	---	2	391	---	---	10	1,285	13	1,961	0.29	0.29
Kansas	---	---	1	205	---	---	---	---	---	---	1	205	0.02	0.03
Kentucky	5	1,474	1	263	10	3,537	4	688	76	9,519	96	15,481	2.15	2.31
Louisiana	8	2,365	3	982	31	10,100	9	1,530	270	35,908	341	50,865	7.48	7.58
Maryland	1	348	---	---	2	410	1	168	11	1,514	15	2,340	0.33	0.35
Mississippi	10	3,019	7	1,852	60	10,332	7	1,258	265	33,224	349	49,675	7.66	7.40
Missouri	---	---	1	264	17	2,294	1	151	165	20,777	184	23,486	4.04	3.50
North Carolina	4	1,390	5	1,603	14	2,585	4	740	188	20,748	185	26,676	4.06	4.00
Oklahoma	6	1,765	3	741	15	3,199	2	308	124	15,108	150	21,121	3.29	3.15
Oregon	---	---	---	---	1	205	---	---	---	---	1	205	0.02	0.03
South Carolina	12	3,592	6	1,720	54	10,884	16	2,292	405	53,206	493	71,694	10.82	10.68
Tennessee	5	1,405	4	1,152	20	3,408	10	1,775	102	11,998	141	19,738	3.09	2.94
Texas	9	2,654	4	1,355	66	12,920	15	2,488	261	36,666	377	56,083	8.27	8.35
Virginia	1	333	2	682	20	3,630	2	516	110	14,740	135	19,891	2.96	2.96
<i>Aedes aegypti</i>														
Alabama	1	285	---	---	4	805	1	168	---	---	6	1,298	0.13	0.19
Florida	---	---	---	---	28	5,298	---	---	---	---	28	5,298	0.61	0.79
Georgia	---	---	---	---	6	1,182	---	---	---	---	6	1,162	0.13	0.17
Louisiana	1	285	---	---	8	1,441	1	168	---	---	10	1,694	0.22	0.26
South Carolina	1	285	---	---	6	1,136	1	168	---	---	8	1,569	0.18	0.23
Texas	4	1,140	---	---	28	5,425	3	319	3	346	37	7,430	0.81	1.11
Hq. & Dist. (2)	74	24,241	19	4,995	58	11,047	200	35,882	117	13,097	468	89,262	10.28	13.38
Puerto Rico	7	2,126	1	319	9	1,683	6	1,389	287	13,871	310	19,328	6.80	2.88
Honolulu T. E.	3	942	---	---	26	4,941	4	630	3	537	36	7,050	0.80	1.05
Total	201	61,762	77	21,416	761	143,402	320	56,426	3,197	387,720	4,556	670,726	100.00	100.00
Percent of Total	4.41	9.21	1.69	3.19	16.70	21.38	7.02	8.41	70.18	57.81	100.00	100.00		

(1) Includes Entomological Inspectors

(2) Includes Headquarters and District Offices, Mobile Units, Malaria Survey, Imported Malaria Control, Special Investigations and employees temporarily attached to Headquarters pending assignment to States.



TABLE III  
NCWA Expenditures and liquidations by Major Items  
AUGUST 1945

	CONTINENTAL U. S.	PERCENTAGE OF TOTAL	PUERTO RICO	PERCENTAGE OF TOTAL
01 Personal Services	\$644,348.87	68.77	\$19,327.52	90.89
02 Travel	36,300.00	3.88	292.04	1.37
03 Transportation of Things	1,065.00	0.11	---	---
04 Communication Service	1,514.25	0.16	16.53	0.08
05 Rents and Utilities	3,619.18	0.39	---	---
06 Printing and Binding	573.40	0.06	---	---
07 Other Contractual Services	11,596.07	1.24	29.20	0.13
08 Supplies and Materials	213,420.46	22.78	1,554.43	7.31
09 Equipment	24,472.77	2.61	43.92	0.22
TOTAL	\$936,910.00	100.00	\$21,263.64	100.00
Expenditures Other than Personal Services	\$292,561.13	31.23	\$ 1,936.12	9.11

TABLE IV  
Typhus Expenditures and Liquidations by Major Items  
AUGUST 1945

	CONTINENTAL U. S.	PERCENTAGE OF TOTAL	PUERTO RICO	PERCENTAGE OF TOTAL
01 Personal Services	\$13,967.34	95.78	\$377.52	100.00
02 Travel	---	---	---	---
03 Transportation of Things	---	---	---	---
04 Communication Services	25.00	0.17	---	---
05 Rent and Utility Service	---	---	---	---
06 Printing and Binding	---	---	---	---
07 Contractual Service	50.47	0.35	---	---
08 Supplies and Material	393.17	2.70	---	---
09 Equipment	146.55	1.00	---	---
TOTAL	\$14,582.53	100.00	\$377.52	100.00
Expenses Other than Personal Services	\$ 615.19	4.22	---	---

TABLE V  
Typhus Control Personnel on Duty and Total Payroll  
AUGUST 1945

AREA	COMMISSIONED		PROF. & SCI.		SUB-PROF.		C. A. F.		CUSTODIAL AND PER HOUR		TOTAL		PERCENT OF TOTAL	
	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY
Alabama	---	---	---	---	4	860	5	626	---	---	9	1,486	13.84	10.36
California	1	423	---	---	---	---	---	---	---	---	1	423	1.54	2.95
Florida	---	---	---	---	1	301	1	361	---	---	2	662	3.08	4.61
Georgia	---	---	---	---	2	357	---	---	---	---	2	357	3.08	2.49
Louisiana	---	---	---	---	1	234	---	---	---	---	1	234	1.54	1.63
Mississippi	---	---	---	---	2	440	---	---	---	---	2	440	3.08	3.07
North Carolina	1	285	---	---	3	780	---	---	---	---	4	1,065	6.15	7.42
South Carolina	---	---	1	312	6	1,234	---	---	---	---	7	1,546	10.77	10.78
Texas	4	1,385	---	---	16	3,070	1	23	4	516	25	4,994	38.46	34.81
Headquarters	4	1,172	1	313	---	---	2	348	---	---	7	1,833	10.77	12.78
Puerto Rico	---	---	1	378	---	---	---	---	---	---	1	378	1.54	2.64
Savannah Unit, Ga.	2	570	---	---	2	357	---	---	---	---	4	927	6.15	6.46
Total	12	3,835	3	1,003	37	7,633	9	1,358	4	516	65	14,345	100.00	100.00
Percent of Total	18.46	26.73	4.62	6.99	56.92	53.21	13.85	9.47	6.15	3.60	100.00	100.00		



TABLE III  
MCWA Expenditures and Liquidations by Major Items  
JULY 1945

	CONTINENTAL U. S.	PERCENTAGE OF TOTAL	PUERTO RICO	PERCENTAGE OF TOTAL
01 Personal Services	\$625,344.35	70.47	\$19,883.39	84.17
02 Travel	22,864.78	2.58	50.00	0.21
03 Transportation of Things	5,387.14	0.61	200.00	0.85
04 Communication Service	1,424.00	0.16	20.00	0.08
05 Rents and Utilities	3,475.18	0.39	---	---
06 Printing and Binding	672.60	0.08	---	---
07 Other Contractual Services	3,941.98	0.44	45.00	0.20
08 Supplies and Materials	211,401.63	23.82	3,423.51	14.49
09 Equipment	12,892.12	1.45	---	---
TOTAL	\$887,403.78	100.00	\$23,621.90	100.00
Expenditures Other Than Personal Services	\$262,059.43	28.70	\$ 3,738.51	15.83

TABLE IV  
Typhus Expenditures and Liquidations by Major Items  
JULY 1945

	CONTINENTAL U. S.	PERCENTAGE OF TOTAL	PUERTO RICO	PERCENTAGE OF TOTAL
01 Personal Services	\$13,136.14	80.96	\$377.52	100.00
02 Travel	---	---	---	---
03 Transportation of Things	---	---	---	---
04 Communication Services	---	---	---	---
05 Rent and Utility Service	---	---	---	---
06 Printing and Binding	---	---	---	---
07 Contractual Service	---	---	---	---
08 Supplies and Material	98.98	0.61	---	---
09 Equipment	2,989.50	18.43	---	---
TOTAL	\$16,224.62	100.00	\$377.52	100.00
Expenses Other than Personal Services	\$ 3,088.48	19.04	---	---

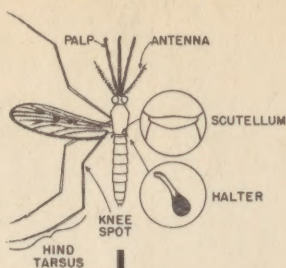
TABLE V  
Typhus Control Personnel on Duty and Total Payroll  
JULY 1945

STATE	COMMISSIONED		PROF. & SCI.		SUB-PROF. (1)		C. A. F.		CUSTODIAL AND PER HOUR		TOTAL		PERCENT OF TOTAL	
	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY	NO.	PAY
Alabama	---	---	---	---	5	1,094	---	---	5	695	10	1,789	16.39	13.24
Florida	---	---	---	---	1	234	1	362	---	---	2	596	3.28	4.41
Georgia	---	---	---	---	1	180	---	---	---	---	1	180	1.64	1.33
Louisiana	---	---	---	---	1	219	---	---	---	---	1	219	1.64	1.62
Mississippi	---	---	---	---	2	440	---	---	---	---	2	440	3.28	3.26
North Carolina	1	253	---	---	4	743	---	---	---	---	5	996	8.20	7.37
South Carolina	---	---	1	312	6	1,241	---	---	---	---	7	1,553	11.48	11.49
Tennessee	---	---	---	---	1	117	---	---	---	---	1	117	1.64	0.87
Texas	3	1,051	---	---	12	2,166	---	---	3	417	18	3,634	29.51	26.89
Headquarters	5	1,819	1	312	1	134	2	409	---	---	9	2,674	14.74	19.79
Puerto Rico	---	---	1	378	---	---	---	---	---	---	1	378	1.64	2.80
Savannah Unit, Ga.	2	570	---	---	2	367	---	---	---	---	4	937	6.56	6.93
Total	11	3,693	3	1,002	36	6,935	3	771	8	1,112	61	13,513	100.00	100.00
Percent of Total	18.03	27.33	4.92	7.42	59.01	51.32	4.92	5.71	13.11	8.23	100.00	100.00		



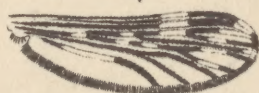
# PICTORIAL KEY TO ADULT FEMALE ANOPHELINES OF UNITED STATES

Palps as long as proboscis  
Scutellum evenly rounded  
Wings usually spotted



GENUS  
*ANOPHELES*

wings with areas of  
white or yellow scales



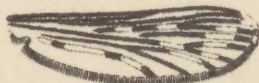
wings entirely  
dark-scaled



two pale areas on  
front margin of wing



one pale area on front  
margin of wing at tip



*CRUCIANS*  
*GEORGIANUS*  
*BRADLEYI*

These three species are  
indistinguishable as adults  
See "Pictorial Key to  
Anopheline Larvae" for  
separation in that stage.

thoracic bristles long  
—about one-third the  
width of thorax



*BARBERI*  
(Eastern U.S.)

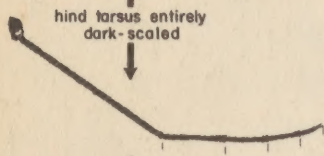
thoracic bristles normal  
—shorter than one-third  
the width of thorax



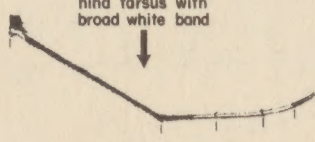
*ATROPOS*  
(Atlantic and  
Gulf Coasts)

Some specimens of  
*atropos* have faintly  
spotted wings. These  
are distinguished from  
other anophelines by  
the absence of light  
knee spots.

hind tarsus entirely  
dark-scaled



hind tarsus with  
broad white band



*ALBIMANUS*  
(Lower Rio Grande  
valley of Texas)

palp with narrow white bands  
halter knobs golden-yellow

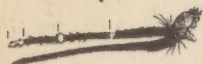


*WALKERI*  
(Eastern U.S.)

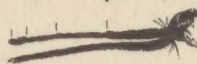
palps unbanded  
halter knobs dark



palp banded

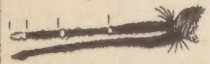


palp unbanded



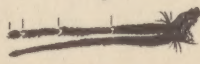
*PUNCTIPENNIS*  
(All of U.S.)

terminal segment of  
palp entirely white



*PSEUDOPUNCTIPENNIS*  
(Southwestern U.S.)

terminal segment of  
palp tipped with black



*FRANCISCANUS*  
(South-central and  
Western U.S.)

coppery-colored fringe  
spot at tip of wing



*OCCIDENTALIS*  
(Northern U.S. and  
Pacific Coast)

no fringe spot



West of the Rockies  
(102° W. Longitude)

these two species are indistinguishable as adults  
*FREEBORNI*  
(Western U.S.)

East of the  
Rockies

*QUADRIMACULATUS*  
(Eastern U.S.)

Prepared by  
Richard H. Daggy  
July 1945



U. S. PUBLIC HEALTH SERVICE  
MALARIA CONTROL IN WAR AREAS  
ATLANTA, GEORGIA